Journal of the Society of Arts.

FRIDAY, MAY 22, 1863.

TWELFTH ANNUAL CONFERENCE.—NOTICE TO INSTITUTIONS AND LOCAL BOARDS.

The Twelfth Annual Conference of the representatives of the Institutions in Union, and of the Local Educational Boards, with the Council, will be held on Friday, the 12th June, at Twelve o'clock noon. Sir Thomas Phillips, Chairman of the Council, will preside.

Secretaries of Institutions in Union are requested to forward, *as soon as possible*, to the Secretary of the Society of Arts, the names of the representatives appointed to attend the Conference.

The chairmen of, or representatives from, the Local Educational Boards are invited to attend. The representatives present at the Conference will be invited to the Society's Conversazione, which will take place on the evening of the same day, at the South Kensington Museum, and will receive their cards on application at the Society's House on the day of the Conference.

CONVERSAZIONE.

The Council have arranged for a Conversazione at the South Kensington Museum, on Friday evening, the 12th June, for which cards will shortly be issued.

THE SOCIETY'S MEMORIAL OF THE PRINCE CONSORT.

The following additional names have been received up to the 21st inst.:—

Appold, John George, F.R.S.	£1	1	0
Buccleuch, The Duke of, K.G.	1	1	0
Hambro, Baron	1	1	0
Hubert, Samuel Morton	1	1	0

DWELLINGS FOR THE WORKING CLASSES.

With a view to promote enlarged investments of capital in model dwellings and other establishments for the benefit of the working classes, the Council of the Society of Arts has instituted a statistical inquiry into the results hitherto obtained, including family dwellings of every description, model lodging-houses, dormitories, refuges, baths and washhouses, soup kitchens, coffee-houses, &c.

Members and others who can supply information or indicate sources where it may be obtained, are requested to communicate with the Secretary, who will send blank forms for being filled up with the required data.

PRIZES TO ART-WORKMEN FOR ART-WORKMANSHIP.

The following notice has been issued by order of the Council* :—

I. The Council of the Society of Arts hereby offer prizes to Art-workmen for the successful rendering of the undermentioned designs in the undermentioned processes of manufacture, according to the directions detailed in each case.

II. Such designs will be by artists of great reputation, to be translated into the various modes of workmanship, and photographs and castings of such designs will be sold by the Society, at the Society's House, at cost price, to persons desiring to be competitors. The prices of the photographs and castings are stated after each subject.

III. The works to be executed will be considered to be the property of the producers, but will be retained for exhibition, in London and elsewhere, for such length of time as the Council may think desirable.

IV. The exhibitors are required to state in each case the prices at which their works may be sold, or if sold previously to exhibition, at what price they would be willing to produce a copy.

V. The awards in each class will be of two grades, and the sums specified in each class will be paid, provided the works be considered of sufficient merit to deserve the award; and, further, in cases of extraordinary merit additional awards will be given, accompanied with the medal of the Society.

VI. The prizes will be presented publicly. Before the award is confirmed, the candidates must be prepared to execute some piece of work sufficient to satisfy the Council of their competency.

1. Modelling in Terra Cotta, Plaster, or Wax.

(*a.*) *The Human Figure in bas-relief.*—One prize of £10 for the best and a second prize of £5 for the next best, work executed after *Rafaelle's design of the "Three Graces."* Dimensions—The figures are to be 9 inches high.

[Photograph—One shilling.]

(*b.*) *Ornament in bas-relief.*—One prize of £5 for the best and a second prize of £3 for the next best, work executed after arabesques by Lucas van Leyden, 1528. Dimensions, 12 inches by 6 inches.

[Photograph—Sixpence.]

2. Repoussé Work in any Metal.

(*a.*) *The Human Figure as a bas-relief.*—A prize of £10 for the best and a second prize of £5 for the next best, work executed after *Rafaelle's "Three Graces."* Dimensions—The figures are to be four inches.

[Photograph—One shilling.]

(*b.*) *Ornament.*—One prize of £5 for the best and a second prize of £3 for the next best, work executed after a Flemish salver in the South Kensington Museum, date about 1670, No. 1153. Dimensions—Ten inches in diameter.

[Photograph—One shilling.]

3. Hammered Work, in Iron, Brass, or Copper.

Ornament.—One prize of £5 for the best and a second prize of £3 for the next best, work executed after an iron German arabesque, about 1520, in the South Kensington Museum, No. 2450. Dimensions—12 inches by 1½ inch.

[Photograph—One shilling and threepence.]

4. Carving in Ivory.

The Human Figure in bas relief.—One prize of £10 for the best and a second prize of £5 for the next best, work

* Copies may be had on application to the *Secretary*.

executed after a Terra Cotta ascribed to Luca della Robbia, about 1420, in the South Kensington Museum, No. 7610. Dimensions—The plaque to be four inches high.

[Photograph—One shilling.]

5. Chasing in Metal.

(*a.*) *The Human Figure.*—One prize of £10 for the bes and a second prize of £5 for the next best, work executed after a reduced copy of *Gibson's* "*Psyche.*"

A rough casting in bronze, on which the chasing must be executed, will be supplied by the Society, price, 12s. A plaster cast may be obtained from D. Brucciani, 39, Russell-street, Covent-garden, W.C., price, 3s. 6d.

(*b.*) *Ornament.*—One prize of £5 for the best and a second prize of £3 for the next best, work executed after a bronze plaque in the South Kensington Museum, No. 1217.

A rough casting in bronze, on which the chasing must be executed, will be supplied by the Society, price 1s.

6. Enamel Painting on Metal, Copper, or Gold.

(*a.*) *The Human Figure.*—One prize of £10 for the best and a second prize of £5 for the next best, work executed after *Rafaelle's design of the* "*Three Graces,*" executed in *grisaille.* Dimensions—The figures are to be four inches high.

[Photograph—One shilling.]

(*b.*) *Ornament in grisaille.*—One prize of £5 for the best and a second prize of £3 for the next best, work executed after a German arabesque (16th century). Dimensions—The same as the Photograph.

[Photograph—Sixpence.]

7. Painting on Porcelain.

(*a*) *The Human Figure.*—One prize of £10 for the best and a second prize of £5 for the next best, work executed after *Rafaelle's* "*Boy bearing Doves,*" in the cartoon of the "*Beautiful Gate.*" Dimensions, the same as the Photograph. This work is to be coloured according to the taste of the painter.

[Photograph—Ninepence.]

(*b.*) *Ornament.*—One prize of £5 for the best and a econd prize of £3 for the next best, work executed after arabesques by Lucas Van Leyden, 1528, and coloured according to the taste of the painter. Dimensions—The same as the Photograph.

[Photograph—Sixpence.]

8. Inlays in Wood (Marquetry, or Buhl), Ivory or Metal.

Ornament.—One prize of £5 for the best and a second prize of £3 for the next best, work executed after a majolica plate in the South Kensington Museum, 1490, No. 1671. Dimensions—The same as the Photograph.

[Photograph,—One shilling and threepence.]

9. Engraving on Glass.

Ornament.—One prize of £5 for the best and a second prize of £3 for the next best, work executed after arabesques by Lucas Van Leyden, 1528, engraved the height of the photograph; and if round a glass or goblet, repeated so as to be not less than 9 inches long when stretched out.

[Photograph—Sixpence.]

10. Embroidery.

Ornament.—One prize of £5 for the best and a second prize of £3 for the next best, work executed after a German example in the Green Vaults at Dresden. Dimensions, according to the taste of the embroiderer.

[Photograph—Sixpence.]

VII. The Council cannot hold itself responsible for any accidents or damages of any kind, occurring at any time.

VIII. Persons intending to compete should give notice, in their own names or by cypher, to the Secretary of the Society of Arts, John-street, Adelphi, W.C., on or before the 15th July, 1863.

IX. Each work must be marked with the name of the Art-workman, or, if preferred, with a cypher, accompanied by a sealed envelope, giving the name and address of the Art-workman, and delivered free of all charges, at the Society of Arts' House, John street, Adelphi, London, W.C., on or before the 31st August, 1863.

COMMITTEES OF REFERENCE.

COMMERCE.

A Meeting of the Committee on Commerce took place on Friday afternoon, 15th of May, Sir Thomas Phillips, Chairman of the Council, in the chair.

The Chairman opened the business by explaining that the subdivision upon which they were now assembled was that of Commerce, doubtless a very wide subject, but it was probable that some especial topics under that head might be suggested, which might hereafter be usefully considered.

The Secretary read the following letter:—

Dear Sir,—I am desirous of suggesting whether this Committee could not advantageously put itself into communication with the Associated Chambers of Commerce. As you are no doubt aware, the Chambers of Commerce in different parts have a common action, with the exception of Manchester and Liverpool, each of which prefers acting alone and independently. The other Chambers have joint action, and meet once a year in London. Now in London there is no Chamber. Each special interest is separately allied, and thus subjects of *general* interest are not taken up by any special body.

Without defining any plan, which of course would require mature consideration, or without more than hinting that the connection might be only at a *touching* point, rather than as a combination or a central head, I venture to urge that the Committee of the Society of Arts might do much in circulating information through Chambers of Commerce, as it has done in other branches of its wide domain—Art and Education, *par exemple.*

The statistical portion of the Committee—presuming there is such a section—could find ample sources of information in the Board of Trade Returns, which, were they more widely used and their contents diffused, would be invaluable to the country, to which they are perfectly accessible, though, for want of machinery for circulation, at present sealed.

Then, again, through the Chambers the Committee could at once extract and condense information on all subjects of importance.

This last would be especially useful in treaties of commerce. The Government wants a machine for extracting information, getting it into shape, and then supplying to them the bases of commercial treaties. British interests are so multifarious that in recent treaties this want of information and of an organised means of obtaining it has been most evident. Probably more will be done for British commerce by means of treaties yet to be made (apart from British energy) than by any other practical mode of action. I am, &c.,

JOHN WHITWELL.

Kendal, May 14th, 1863.

P. Le Neve Foster, Esq.

The Chairman said he should be happy to hear sug-

gestions as to whether the objects of the Society could be promoted by any organisation in connection with the Chambers of Commerce.

Mr. OGILVIE thought an organisation in London would be desirable. Although an annual conference of the Chambers was held, there did not appear to be any regular organisation of those bodies for any practical purposes. He doubted whether the question of copyright came under the province of this Committee, and remarked that he believed at the present moment the question of copyright was under consideration in France with a view to some alteration in the law there.

The CHAIRMAN remarked that he believed in France there was a desire to give more consistency to the laws of copyright than there was at present. It was discussed at some length at a recent meeting of artists whether copyright of all kinds, literary and artistic, should not be placed on the same footing. It had also been discussed whether any attempt should be made during the present session of Parliament to remedy certain supposed defects in the present law of Art Copyright, but a recent case, decided in the Court of Common Pleas, had shown that the existing law was sufficient for the protection of engravings from photographic piracies. Another question had arisen as to whether they could usefully promote the assimilation of the law of copyright throughout the various European countries.

Mr. F. LAWRENCE thought the subject of copyright hardly came within the scope of this Committee, except as regarded the question of trade marks, which required to be treated differently to copyright of designs, &c. The law with regard to trade marks was undoubtedly very imperfect and unsatisfactory.

A MEMBER of the COMMITTEE inquired whether the Society had taken any action on the subject of uniformity of weights and measures throughout the kingdom?

A conversation then ensued on this subject, when Mr. DILLON stated that a bill was now being introduced into Parliament by Mr. Ewart for legalizing the metrical system in this country.

The conversation then turned upon the subject of decimal coinage and the various schemes which had been propounded for the establishment of a decimal system of currency and accounts in this country. Whilst the advantages of such a system were for the most part admitted, the difficulties in the way of its adoption were adverted to.

Mr. LAWRENCE thought that with the great extent of our commercial operations a change of system would be attended with difficulty, although no doubt the community would gradually adapt themselves to the altered state of things. With regard to the greater facilities of accounts under the decimal system, he thought it must be a large establishment where the services of one clerk could be saved under that system.

After some remarks by Mr. SYMONDS, Mr. FISHER, and others,

The CHAIRMAN inquired whether any member of the committee had any suggestions to offer on the subject of international postage, as one bearing largely upon commerce.

Mr. RIDLEY asked what was the object of the Congress at present sitting in Paris on the subject of postal communication, to which it was replied, that it was understood to be to establish a system of parcels post.

Mr. OGILVIE said he believed the object was to assimilate the postage rates on the Continent with our own, but the French gramme stood in the way of that assimilation.

The CHAIRMAN inquired whether any improvements could be suggested with reference to the postal communication with our colonies.

Mr. LAWRENCE replied, that since the recent reduction it had been very satisfactory. Mr. Lawrence mentioned anomalies that existed between the French and English systems of postage, in which in cases of unpaid letters grievance was often inflicted.

Mr. KERR called attention to the high rate of postage between this country and America, the charge at present being 1s. per letter. He thought so high a charge was much against the postal interests of both countries.

Mr. SYMONDS mentioned that delegates had assembled in Paris on this subject, and he suggested that it might be desirable to ascertain the result of their deliberations.

Mr. H. WEBBER reopened the subject of the anomalies in weights and measures in this country, and remarked that before they could expect uniformity in other countries, it behoved them to set their own affairs in order. Weights and measures varied very much in different parts of the country. He suggested that a practical means of procuring uniformity of weights and measures might be obtained through the operation of a central body in London, who should communicate on the subject with the great centres of trade throughout the country.

The CHAIRMAN said he knew no better organisation for that purpose than the present Chambers of Commerce.

The proceedings then terminated.

TWENTY-THIRD ORDINARY MEETING.

WEDNESDAY, MAY 20, 1863.

The Twenty-Third Ordinary Meeting of the One Hundred and Ninth Session was held on Wednesday, the 20th inst., William Hawes, Esq., Vice-President, in the chair.

The following candidates were proposed for election as members of the Society:—

Angell, Lewis	8, Middleton-terrace, Merton-road, Wandsworth, S.W.
Craig, John	20, Parade, Harleyford-road, Vauxhall, S.
Downes, Thomas Ring	1, Park-cottages, Adelaide-road, Haverstock-hill, N.W.
Elderton, Edward M.	28, St. George's-square, S.W.
Elliott, John	2, Finsbury-pavement, E.C.
Farthing, J. Johnson	36, Great George's-sq., S.W.
Waine, William	Newington-butts, S.
Walker, Thomas	Speedwell House, Birmingham.

AND AS HONORARY CORRESPONDING MEMBER,

Newbery, Joseph Vickers. Shanghai, China.

The following candidates were balloted for and duly elected members of the Society:—

Alexander, Rev. D. M.	Oldham.
Astles, Frederick W.	The Laurels, Smethwick, near Birmingham.
Cardwell, Thomas	8, Up. Hyde-park-gardens, W.
Dean, Alfred William	32, Queen's-road, Regent's-park, N.W.
Dickson, J.	66, Tollington-road, Holloway, N.
Dorling, Henry	62, Warwick-square, Pimlico, S.W.
Tucker, B. R.	3, Albert-terrace, Charlton, Dover.

AND AS HONORARY CORRESPONDING MEMBER,

Lombard, Edouard Auguste, Genève.

The CHAIRMAN said that as there were so few members present, owing probably to its being the evening of the Derby day, he would suggest that it would be better that the paper announced for that evening should be postponed to the next meeting.

This proposal appearing to meet with the approbation of the members present,

The SECRETARY announced that on Wednes-

day evening next, the 27th inst., the paper by Mr. B. H. Paul, Ph.D., "On Destructive Distillation, Considered in Reference to Modern Industrial Arts," would be read.

ON THE DISCOVERY OF THE METAL THALLIUM.

The following Lecture, by Mr. William Crookes, was delivered at the Royal Institution, on Friday, March 27, 1863:—

So many brilliant discoveries have been announced to the world in this theatre, that it was with some diffidence I acceded to the request of the learned secretary of this Institution to relate to you to-night the history of the discovery of thallium. The discovery of a new metal is no novelty in this century. Since its commencement our acquaintance with the material world has been enlarged by the discovery of no less than thirty-two of these elements, and the particular and especial interest with which the three latest additions are regarded attaches as much perhaps to the means by which their existence has been revealed to us as to the metals themselves.

Some of the bodies called metals have been known as such from the earliest times. We have no record nor knowledge of the first discovery of the seven ancient metals—gold, silver, iron, copper, mercury, lead, and tin. I may remark, however, that they are metals which are either found native, or such as are easily separated from their ores by the agency of heat alone, or by the simplest chemical means. Of the rest I may briefly say that a large majority were first discovered by the employment of what I may call exclusively chemical methods. The exceptions to this rule are those whose discovery makes the early part of this century a marked epoch in the history of chemistry and of this Institution. These are the alkaline and earthy metals first obtained by Sir Humphrey Davy by means of voltaic electricity. I need not detain you now by dilating on the great impulse which the employment of this force in the decomposition of suspected metallic compounds gave to the progress of chemistry, and the fruitful results which have attended its use. No means have been attended with such brilliant and useful results until the researches of Bunsen and Kirchhoff definitively applied spectrum analysis to the recognition of elementary bodies.

You have heard and seen so much of the spectrum this season, that it might almost require an apology for introducing the subject once more, were it not that the discovery of thallium is inseparably associated with this method of analysis.

I may here point out one peculiarity with regard to the metals discovered by this method. It is this:—That whereas in the case of most bodies discovered in other ways some compound of them was known, and the metallic nature of the base was suspected; or some particular reaction had before convinced the discoverer that he had a body endowed with hitherto unrecognised properties in his hand; yet, in the case of spectrum analysis, no knowledge or suspicion of the metals themselves, or of any compounds, existed until, as I may say literally, they were first brought to light. The fact of their existence then flashed upon us at once.

A curious historical parallel may be mentioned in connection with the discovery of thallium, and here I must ask to be excused a more frequent use of the pronoun I (which I make with reluctance, and to avoid periphrasis) than is generally heard in lectures of this kind.

The discovery of thallium is strictly analogous to that of selenium by the great Swedish chemist, Berzelius.

In each case the original source was some residue from a sulphuric acid manufactory burning pyrites. From some unexplained reaction the presence of the rare element tellurium was suspected. Further examination led to the discovery, by Berzelius, of the element selenium, whilst in my own case the result of the investigation was the discovery of thallium.

Had spectrum analysis been known at the beginning of this century, there is no doubt that Berzelius would have added thallium to the other elements which he was the first to isolate, for I do not hesitate to say that without this powerful means of research thallium would have remained unknown at the present time. The residue was from a manufactory at Tilkerode, in the Harz, and had been placed at my disposal, in 1850, by Professor Hofmann, for the purpose of extracting the selenium from it. This was effected in the ordinary way, and the crude selenium was purified by distillation in hard glass retorts. A considerable residuum was left behind in this operation, and as a few tests seemed to show that tellurium was present in this residue, it was set aside for further examination. Early in the year 1861, happening to require some tellurium for experimental purposes, I sought for this residuum, and examined it more minutely for this element, but without getting very definite results. The chemical tests seemed to give contradictory evidence, when, not succeeding in meeting with tellurium where there were many chemical reasons for suspecting its presence, I had recourse to the spectroscope. I expected to see a system of fine, nearly equidistant, bands of light and shade traversing the spectrum, but instead of this a single brilliant green line flashed across the field of view. [The spectrum of thallium was here projected on the screen, its remarkable green band appearing like an incandescent bar upon a perfectly dark background, the metal being placed between the carbon poles of a forty-cell Grove's battery.]

The chemical treatment through which the substance examined had passed was such as to preclude the possibility of other than the elements antimony, arsenic, osmium, selenium, or tellurium being present, and I well knew that none of these bodies gave a spectrum in any way similar to this. I was therefore convinced that a hitherto unrecognised element was present, and at once devoted myself to the task of isolating it. It would weary you were I to recount the numerous experiments made with this object. The whole amount of the original seleniferous deposit which I had at my disposal was not more than three pounds in weight, and later analysis have proved that the total quantity did not contain more than three grains of thallium. The invaluable assistance afforded by the spectrum test at last enabled me to announce definitely* that I was dealing with a new element, and to give a sufficient number of its reactions to show that its chemical properties were well marked and perfectly distinct from those of all other known bodies.

At first I had doubts as to the chemical position of the new body, and, arguing from the reactions I had then ascertained, I was rather inclined to class it amongst the metalloids or semi-metals. After some months' labour, Dr. Thornthwaite, in the most generous manner, placed at my disposal two cwt. of sulphur, likewise containing about one grain of thallium per pound. With this I was enabled to prosecute my experiments, and before long had isolated the metal not only in the form of a black powder by the action of zinc, but in distinct metallic crystals by voltaic precipitation; all doubt as to the actual metallic character of the element now disappeared.

I had already decided upon a name for the new body.† With the assistance of a friend, a skilful linguist, the word thallium was chosen, from the Greek θαλλὸς (a green twig), which seemed to recal the green line of its spectrum, and to be adapted for the requirements of chemical nomenclature better than malachium, smaragdinum, viridium, and others which were thought of. The name

* *Chemical News*, iii. 191. † Ibid., iii, 303.

thallium was at once adopted by the scientific world as appropriate.

Whilst speaking of the metallic nature of thallium, it becomes a duty no less than a pleasure to mention that M. Lamy, a very skilful Belgian chemist, who had been fortunate in meeting with a rich source of the new body in May last, has, independently of my own researches, determined its metallic nature, and obtained it in considerable quantity. M. Lamy's specimen of thallium was exhibited to a large meeting of scientific gentlemen of all countries soon after the opening of the International Exhibition, and naturally excited great interest among them. It was afterwards placed in the Exhibition building, where, however, amid the splendours with which it was surrounded, it scarcely attracted the notice it deserved.

I first obtained the metal in crystals by voltaic action in September, 1861,* and, although I have since witnessed the operation many hundreds of times, I know of no other experiment of a similar kind which can at all compare with it in beauty.

I have arranged on the table a small apparatus in which the crystallisation of thallium is now proceeding under the influence of two or three cells of Grove's batteries. By the end of the lecture I have no doubt you will find that the bottom of the dish will have become almost covered with beautiful metallic crystals.

In order to render this visible to all my audience, I have placed some of the same solution of sulphate of thallium in a small glass cell containing the platinum terminals of two Grove's batteries. I will endeavour to project an image of these poles on the screen by means of the electric microscope, during electrolysis. In an experiment of this kind, in which I cannot detain you many minutes, some of the beauty and delicacy of the forms must necessarily be sacrificed to rapidity of crystallisation; but still I think you can all see the slender branches and fern-like vegetation in which the metallic crystals are shooting across the liquid.

Thallium comes down with such ease from its solutions under voltaic influence, that I now invariably adopt this plan for reducing it in the first instance, in preference to precipitating it with metallic zinc.

In order to obtain the metal in the coherent form, it is now only necessary to squeeze it together and fuse it under cyanide of potassium, when it is obtained in the form of an ingot.

Hitherto I have been working under great disadvantages, owing to my small stock of materials; each experiment requiring nearly the whole of my scanty store, which had then to be worked up again into an available form for the next experiment, causing great and unavoidable sacrifice both of time and material. Thanks, however, to the munificence of the Royal Society, my investigations will no longer stop for want of material, and I am now in communication with Mr. Spence, one of the largest burners of thalliferous pyrites in this country, who has, in the most handsome manner, offered to alter his flues, so that the greater portion of the thallium, which is now lost in the sulphuric acid, may be saved.

And now, having finished the history of the discovery of thallium, I shall follow the plan usually adopted in describing metals. And first as to the source. Up to the present time, the only available one is iron pyrites, such as is used largely, both in this country and on the continent, for making sulphuric acid. I have here before me a few specimens of one of the richest thalliferous pyrites which I have yet met with. It is brought from Belgium, and is largely used, both here and abroad, in the manufacture of sulphuric acid. The mineral being burnt in properly-constructed furnaces, the volatile products of its combustion are passed into large leaden chambers, where the sulphurous acid is mixed with nitrous vapours and steam, and becomes converted into sulphuric acid. Now, when the sulphur of the iron pyrites is burnt the product is a gas, and when the *thallium contained in the pyrites* is burnt the product is a volatile solid. By reason, however, of the great excess of sulphurous acid, and its high temperature (owing to the proximity of the leaden chamber to the furnace), nearly the whole of the thallium is carried through into the lead chamber, where it dissolves in the dilute sulphuric acid, forming sulphate of thallium, a soluble salt. In this case the thallium is lost, for it would be a most tedious and expensive operation to extract it from the acid, which, indeed, is no richer in thallium than the original ore. Thallium may, *however*, be readily detected in many samples of crude oil of vitriol, as well as in commercial products and chemicals which are made from it. Thus, the very common yellow hydrochloric acid, worth about 1d. per lb., often contains it. I have here a bottle of this acid, obtained from Messrs. Chance, Brothers, of Birmingham, and in this tube [exhibiting a specimen tube] I have a lump of pure metallic thallium, which I prepared from 1 cwt. of the acid. Owing to the imperfect means adopted to isolate the metal much of it was lost, but the piece actually obtained weighs upwards of five grains.

Let me also draw your attention to some of the other thalliferous substances which are on the table before you. Here is a fine specimen of cake-sulphur, some sulphide of cadmium, metallic cadmium, and metallic zinc, all from Nouvelle Montagne; a large ingot of Spanish copper; some sulphur, also from Spain; specimens of bismuth ores, with precipitated carbonate of bismuth, also thalliferous, recently purchased at a druggist's; commercial sulphate of copper, some pieces of selenium, and a quantity of metallic tellurium, in which thallium is present rather largely. There is also a large collection of thalliferous pyrites from all parts of the world, and a small specimen of native sulphur from Lipari, said to contain selenium, but which I have found so rich in thallium that it deserves to be classed as a new mineral.*

I have given you a brief outline of the path followed by the thallium in most of our sulphuric acid works. Fortunately, in some manufactories a slight modification is adopted, which permits of the accumulation of this metal in the flues. Instead of the sulphurous acid, &c., going direct from the furnace into the lead chambers, it passes through a greater or less length of flue, where the temperature becomes lowered sufficiently to deposit much of the thallium and other solid volatile matter (*e.g.*, mercury and arsenic) which it may contain. In this flue-dust, as it is called, I have frequently detected thallium, and in some instances in sufficient quantity to render its extraction well worth undertaking. In M. Kuhlmann's works at Lille the products of combustion of the pyrites are passed first into a supplementary chamber, where they are cooled down, and deposit nearly the whole of the thallium, arsenic, &c., before entering the converting chambers. This accounts for the richness of the deposit employed by M. Lamy for his researches.

The richest pyrites which I have yet examined have yielded me no more than ten ounces of thallium to the ton of ore. This may seem too minute a proportion to be worth noticing; but in 1,000 tons it amounts to nearly 6 cwt., and as 8 or 10 tons of ore are burnt daily in some of our largest vitriol works, I do not think I was exaggerating when I said, nearly a year ago, that

* At the Lecture I inadvertently said 1862 instead of 1861. —W. C.

* This was a small mineralogical specimen obtained in 1861 from Mr. Sowerby, geologist, Strand. It was labelled "Sulphur coloured with selenium, from Lipari," and consisted of very dark-coloured crystallised sulphur mixed with chloride of ammonium. Analysis showed that selenium was absent, but that it was very rich in thallium. Notwithstanding my repeated endeavours, I have hitherto failed in obtaining a further quantity of this mineral; a fine specimen of native sulphur which Dr. Hofmann most obligingly obtained for me direct from Lipari having been found quite free from thallium.—W. C.

thallium was in some works being thrown away by the hundredweight, the whole of which might be saved if manufacturers could be induced to modify their flues so as to effect its proper condensation.

Through the kindness of Professor Chandelon, of Liège, two tons of thalliferous pyrites from the Société Anonyme de Rocheux et d'Oneux, Theux, were placed at my disposal. After considerable delay, this arrived at my laboratory in September last, and from that time almost to the present I have been constantly engaged in extracting the thallium from it.

The first operation consists in breaking up the pyrites into lumps the size of a walnut, and distilling the sulphur from it. For this purpose hexagonal iron pipes, closed at one end, are arranged in a reverberating furnace, five at a time, so that the flame can lick round and raise them to a bright red heat. Each retort contains 20 lbs. of mineral, and has an iron tube receiver luted on to the end of it. After some hours' heating the operation is terminated, and the receivers contain from 14 lbs. to 17 lbs. of dark green or grey-coloured sulphur from each cwt. of ore. This appears highly thalliferous when examined by the spectrum test, but when treated chemically I have not succeeded in obtaining a larger yield from it than ten grains of thallium per pound of sulphur.

The separation of the metal from this sulphur is a matter of some little difficulty to one unprovided with the resources of a manufacturing laboratory. Indeed, I should have been quite unable to show you such pieces of thallium as I have here to-night, had not Messrs. Hopkin and Williams, the well-known manufacturing chemists, undertaken to perform the subsequent operations in their well-appointed works at Wandsworth. In less time than it used to take me in my private laboratory to work up ten pounds of sulphur, they have prepared for me the chloride of thallium from two cwt. The process adopted is briefly as follows:—The sulphur is powdered and boiled in a large iron pan with a solution of caustic soda until it has all dissolved, with the exception of a black precipitate suspended in the liquid. After cooling, it is filtered, washed, and the precipitate boiled in sulphuric acid. When all has dissolved that will, it is filtered, and hydrochloric acid is added to the filtrate, which determines the formation of the difficultly soluble protochloride of thallium. This is filtered off, washed once with dilute hydrochloric acid (in which it is less soluble than in pure water), and converted into sulphate. From the solution of this salt the metal is precipitated by voltaic electricity, as is now in operation on the table.

In order to obtain this spongy thallium in the coherent form it is not even necessary to fuse it. There is in this bottle of water a quantity of metallic sponge—the results of this day's precipitation in my laboratory—I merely have to knead it into a lump between my fingers, and then put it into a steel crushing mortar, without even taking the trouble to dry it. I now submit it to powerful pressure in this vice, and you see that I have produced a brilliant metallic-looking ingot, perfectly solid, as can be told by the sound when thrown upon the table.

Well, now, having obtained the thallium, let me draw your attention to its chief characteristics, wherein it agrees with or differs from its fellows. It is a white, opaque metal, endowed with a perfect metallic lustre, as may be seen at the close of the lecture by examining the beautiful crystals now being deposited all over the bottom of this dish. Metals are usually divided into two classes, light and heavy; thallium certainly belongs to the heavy metals, not only on account of its specific gravity, which is 11·9, a trifle higher than that of lead, but also for other reasons which I shall come to presently. It is very malleable, and may readily be rolled into leaves as thin as tissue-paper, as shown by the specimen of foil before you. It is not very ductile, and can only be drawn into wire with great difficulty. By employing pressure, however, thallium wire can be made with the utmost facility. I have here a small hollow steel cylinder, with a piston fitting tight into it: at one end is a very fine hole, and upon filling the cylinder with thallium, and forcing in the piston by means of the vice, the thallium issues out through the fine hole in the form of wire. I have arranged an apparatus here by which the wire as it issues from the cylinder is conducted along a glass tube into a specimen bottle, a current of dry carbonic acid passing through the apparatus all the time. By means of the electric light I project the image of the specimen bottle on to the screen, and by giving one or two turns to the screw of the vice you perceive the wire issuing forth and curling up in folds like a thick rope. The bottle is now filled with the coil of wire, and if I cement the stopper in, the specimen will preserve its metallic lustre and brilliant surface unchanged.

Thallium is very soft, in fact it is the softest known heavy metal, being only exceeded in this respect by the alkali metals. A piece of lead scratches it, as you perceive, with the utmost facility, without itself receiving an appreciable impression. It also possesses the property of welding together in the cold by pressure. I can illustrate this by taking another steel cylinder and filling it with several pieces of metallic thallium. [Fourteen pieces were put in.] A turn of the vice forces it out, as you see, into one solid rod, which, upon examination, will be found just as continuous and coherent as that made from one lump.

Thallium marks paper like plumbago, forming a streak having a yellow reflection. The mark almost entirely fades out in a short time from oxidation. A week ago I wrote a word upon this sheet of paper; upon close examination I can just read it, but I do not think it is visible to any one else. I have, however, merely to pass over it a sponge which has been dipped into sulphide of ammonium, when the word "thallium" appears black, and visible to all.

The electrical conductibility of thallium has been recently examined by Dr. Matthiesson, to whose instruction I am indebted for the wire-working process just shown. He finds it near lead in this respect. His researches were communicated to the Royal Society a few weeks ago.

The magnetic relations of thallium are very interesting. Professor Faraday has been good enough to arrange an experiment by which its behaviour under the magnetic force can be rendered clearly visible to all in the room. A small sphere of thallium is fastened to the short end of a light wood lever, a square index of white paper being at the other extremity. The lever is suspended horizontally by some long threads of cocoon silk in such a way that the sphere all but touches one of the conical poles of the large electro-magnet belonging to this Institution. I now pass the current of forty Grove's batteries round the electro-magnet, when you see, from the large arc travelled over by the paper index, how violently the thallium sphere is repelled from the pole of the magnet. It is, in fact, next to bismuth, the most diamagnetic metal known.

Thallium is easily fusible, melting at a temperature of 555° Fah.; at a full red heat it may be distilled, but it begins to evolve vapours at a lower point. If I heat a piece on charcoal before the blowpipe, you perceive the metallic vapours flying off copiously, colouring the flame a rich green. The colour which it communicates to flame is better shown by holding, in a colourless gas flame, two or three platinum wires having an alloy of thallium and platinum fused on to their ends. I will place by the side of this other two flames coloured respectively with barium and copper, when you can judge of the extreme richness and purity of the thallium green by the manner in which it appears to kill the others.

Thallium burns brilliantly in oxygen, and small fragments of the metal also take fire when thrown into a gas flame, giving rise to an intense green light. Exposed to the air it tarnishes very quickly; indeed, with almost the

rapidity of alkali metal, becoming coated with a film of oxide, yellow at first, and gradually darkening. This oxide is tolerably soluble in water, forming a highly alkaline solution. It, however, differs radically from potash and soda, and closely approaches oxides of silver and lead (which are likewise soluble and alkaline) in having scarcely any affinity for water; it being rendered anhydrous even at the ordinary temperature in a vacuum. I can illustrate the alkaline character of its oxide by taking this ingot of thallium, and rubbing a piece of moistened turmeric paper on a white plate. Wherever the thallium has touched a brown mark is produced. If I apply the tarnished surface of the metal to the tongue it tastes very caustic and biting, and somewhat metallic. When I place a piece of tarnished thallium in water, the superficial film of oxide dissolves, and exposes a bright surface of metal. Hot water cleans it at once, and renders the surface crystalline, like tinplate washed with acids. If the thallium be quite pure, and the water free from air, no sensible action appears to be exerted on the metal, but when exposed to the joint action of air and water it is gradually oxidised. Curiously enough alcohol acts upon it more than water does. The soluble oxide (the protoxide) is also formed very rapidly when thallium is melted in the air; it then fuses like litharge, and is absorbed in the same manner into a bone-ash cupel. When thallium burns in oxygen a peroxide is formed.

Thallium dissolves in acids, its proper solvent being nitric acid; it forms two if not three basic oxides and an acid oxide. The salts of the protoxide are the only ones which have been much studied. They are well-defined series, most of them being beautifully crystalline. Many of these compounds have been very skilfully investigated by MM. Lamy and Kuhlmann, jun. Some of the proto-, sesqui- and per-salts are on the table, as also one or two thallates. Let me especially draw your attention to the beauty of the crystallised sulphate, nitrate, and chlorate of the protoxide, the yellow sesquichloride in glistening spangles, and this large bottle full of the protochloride, upwards of a pound in weight.

On the table before me I have arranged three series of test glasses, the upper row containing protosulphate of thallium, the middle row nitrate of silver, and the bottom acetate of lead. To these I will apply the ordinary tests used in chemical analysis, and I think there is no doubt that my chemical friends who are present will admit with me that the true position of thallium is by the side of these two metals, and not, as M. Dumas and other French chemists affirm, in the potassium and sodium group.

Gas light not being very well adapted for showing shades of colour, I have arranged to illuminate the table with electric light during these tests. I first add hydrochloric acid to the solutions, a white precipitate falls in each case; the protochloride of thallium being scarcely distinguishable from chloride of silver; it is, however, slightly soluble in water. Iodide of potassium gives a yellow precipitate with each metal. Bichromate of potash a yellow precipitate with thallium and lead, and a red one with silver. Sulphocyanide of potassium gives white, and sulphide of ammonium black precipitates in all three metals. Bichloride of platinum produces an insoluble double salt with thallium, and precipitates the silver and lead as chlorides. Ammonia produces no change in the thallium solution; gives a precipitate with silver, which redissolves in excess, and permanently percipitates the lead salt. Sulphuretted hydrogen has likewise no action on the thallium salt, but precipitates the other two. When, however, I add ammonia to the thallium after addition of the sulphuretted hydrogen, a black precipitate is produced, and finally sulphuric acid produces (of course) no change in sulphate of thallium, a slight crystalline precipitate in nitrate of silver, and a dense white one in acetate of lead. From these tests you therefore perceive that whilst the similarities between the three metals are very great, there are, nevertheless, characteristic differences, though not greater than between most nearly allied metals.

I have only time to show two reactions with solution of sesquichloride of thallium; the first is the precipitation of the slightly soluble protochloride upon addition of sulphite of soda, and the second the formation of a brown peroxide and precipitation of protochloride in crystals upon addition of ammonia. This latter reaction is a very curious one.

Let me, in conclusion, say a few words respecting the position of thallium amongst elementary bodies. In classification observers generally err in regarding natural bodies as so many lengths in a perfect chain, and facts are frequently strained in order to make them agree with this preconceived opinion. In such a group as chlorine, bromine, and iodine, we have, doubtless, three consecutive lengths; but most frequently Nature should be looked upon more as a perfect net than a perfect chain. In seeking for the chemical relationships of thallium, it is found that this metal occupies a somewhat anomalous position, being well described by an eminent French chemist as the ornythorynchus of metals. At first sight it might appear to belong to the group of alkali metals, on account of its forming a readily soluble, highly alkaline oxide; it likewise forms an insoluble platino-chloride, which also renders it analogous to some of the alkali metals, although not to others; but, on the other hand, its physical characters, its chemical reactions, and its high atomic weight (about 203), prove incontestably that the true position of thallium in the scale of elements is close to lead and silver.

In these utilitarian days a discoverer must be prepared to give some kind of answer to the question,—" What is the use of it?" Now, the possible uses of a body depend chiefly on its abundance, and as soon as thallium is procured by the ton at no greater cost than it is now by the ounce, it will certainly be utilised in many directions. In the pure metallic state it probably tarnishes too readily, and is too quickly acted upon by atmospheric agencies for it to possess much practical value in this form. In the form of alloy, however, its uses are likely to be very great, as it readily mixes with many metals, and communicates to them valuable properties.

The magnificent green which it communicates to a flame at once suggests a valuable application of thallium for pyrotechnic purposes. At the ordinary temperature of flame, the thallium light is absolutely homogeneous, and even at the high temperature of the electric arc, the other lines, which Dr. Miller has shown are produced, and which I have attempted to copy on this diagram, fade before the brilliancy of the characteristic green line.

Perhaps the best way for me to show the magnificent green light evolved by incandescent thallium vapour is by projecting on the screen the highly-magnified image of the thallium electric arc. I have scooped out the lower carbon of the electric lamp into the form of a small cup, and, upon placing ten or a dozen grains of thallium in it, and making contact, the upper pole can be separated for a space of an inch or more, voltaic connection being maintained by the bridge of thallium vapour rising from the cup. The image of this on the screen fills up a space of twelve inches or more with absolutely monochromatic green light, and if I introduce into this green space variously-coloured bodies, a bouquet of bright flowers, or even my own face, you will see the strange changes it produces in the apparent colours of bodies, everything being either green or black, just as in the sodium flame every object is yellow or black.

The reason why the homogeneous light given by sodium and thallium is so intense is owing to all the luminiferous energy of the element being concentrated into one ray, instead of being diffused over different portions of the spectrum.

These experiments show that thallium is pre-eminently the pyrotechnic element; but regarded for the present merely from a scientific point of view, its early history will always be looked upon with interest, as proving the beauty and accuracy of spectrum analysis, and the striking manner in which the deductions therefrom have been confirmed.

TELEGRAPHING BY SOUND.

Telephonography is the word which Dr. J. B. Upham, of Boston, Massachusetts, now chief of the Stanley General Hospital, Newbern, N.C., applies to a system of signalling by sound, which for some months he has been engaged in bringing to a form for practical use in the army and navy. Great embarrassment has occasionally resulted in the concerted operations of our forces which have been attempted in thick or foggy weather, from an inability to communicate by the common signals of flags or lights. It is well known that telegraph operators very speedily learn to read messages by "the click of the machine," without the necessity of looking at the recorded marks. This fact suggested the practicability of communicating messages by sound. More than a year ago Dr. Upham obtained, by the courtesy of Eastern Railroad officers, the use of two locomotives for the purpose of an experimental talk by the sounds of the steam whistle. One engine was placed near the station in Boston, and the other ran out to "Prison Point," Charlestown. The day was foggy but still. An alphabet to be used was agreed upon, and an expert telegraph operator was placed at each steam whistle. There was not the slightest difficulty in communicating, and questions and answers were recorded by both parties and compared. To remedy the very unpleasant ear-splitting sound of the common steam whistle, Dr. Upham has attached to it several contrivances in the form of a bell, of a French horn or trombone, or a reed fixture like a clarionet. These instruments can be made to give a very loud sound by a pump for forcing air, which can be easily moved from place to place. Dr. Upham has lately made many experiments with trumpets in the field, on foot, and on horseback—in row boats on the river Neuse, and with the steam whistle on the railroads and steamboats—and finds no difficulty in transmitting with trumpets any message, however long or complicated, the distance of a mile, or with the steam whistle the distance of three miles. Ample facilities for these experiments have been given by General Foster, in the way of furnishing men, engines and boats, and the results reached are considered of great prospective value.—*Boston, U.S., Journal.*

INTERNATIONAL POSTAGE.

The Paris correspondent of the *Times* says:—A meeting of the congress appointed by the different European Governments for the purpose of establishing a general system of international postage was held on Monday, at the Hotel des Postes, consisting of the following members:—For Austria, M. Löwenthal, Councillor of the Ministry of Commerce; Belgium, M. Fassiaux, Director General of Railways, Post Offices, and Telegraphs; Denmark, M. Martin Levy, Secretary of the Danish Minister of Finance; Spain, Count de Nava de Trajo, Sub-Director at the department of Foreign Relations in Spain; United States, Mr. Kasson, Deputy Postmaster-General of the United States, and Mr. Mohle, Assistant; France, M. Vandal, Councillor of State, Directeur Général des Postes, and M. Maurin, Head of Foreign Correspondence at the French Post-Office; Great Britain, Mr. F. Hill, Secretary to the General Post-office; Italy, Chevalier Pagui, Inspector-General of Italian Post-offices, and Chevalier Agostini, head of section in that department; Holland, M. J. Hofstede, Inspector of the Central Dutch Post-office; Portugal, Chevalier d'Autas, Councillor and Secretary of the Legation at Paris; Prussia, M. Metzner, Superior Councillor of the Post-office at Berlin; Sandwich Isles, Sir J. Bowring; Switzerland, M. Kern, Swiss Minister-Plenipotentiary at Paris, and M. Paul Jeanrenaud; Hanse Towns, M. Johannes Rosing, Secretary of Legation. The object of the congress is to introduce, not only a uniform system of payment, but of weight and general postal legislation, and to turn to account, in the general correspondence between civilized nations, such improvements as have been found practicable and useful.

Home Correspondence.

LIGHTING RAILWAY TRAINS WITH GAS.

Sir,—Perhaps you will permit me to make a few further observations in explanation of my own views of the difficulties to be overcome in the lighting of railway trains with gas, as well as to answer some of the remarks made at the meeting of the Committee of Reference on Mechanics and Engineering.

The pioneers in this country, in the construction of apparatus for compressing gas, and using it in in a portable form, were, Thelluson, Gordon, and Heard; and more recently in France, a system has been adopted of supplying rich portable gas, which has extended itself to various other important towns on the Continent, and with a very fair amount of success. There are companies established at Paris, Milan, Turin, and Moscow, their object being chiefly to supply gas to those parts not within the range of the ordinary gas companies' mains, so that they do not act antagonistically to them. M. Hugon, of Paris, is more or less at the head of each of them, he being the gentleman whose mode of production, compression, and regulation of the gas, has been adopted. In America, the steamboats and some of the railway trains are lighted with gas made on the boat or train, as well also as by the means which have so frequently been tried in this country.

Thompson and one or two others have been tolerably successful in the lighting of railway trains, but it may be presumed that their systems have many objections, or railway companies would assuredly adopt some such plans of lighting their carriages, which for many self-evident reasons are preferable to oil; indeed, Mr. Teulon, by his remarks, and as representing the railway interest at the meeting of the Committee, clearly showed that while he was thoroughly acquainted with what had already been done, yet that the result, so far, was anything but satisfactory, at least not so much so as to warrant the companies adopting it generally.

I am aware that the gas, as delivered at the houses of customers at Paris, which is stored in reservoirs at five atmospheres pressure, is readily regulated from that pressure down to that which is necessary for being properly burnt—say equal to a column of water five or six-tenths of an inch in height, but the means by which that is accomplished there cannot be made available for lighting railway trains with gas.

I venture to say that there are considerable difficulties to overcome before a proper system of lighting railway carriages, as we now find them, and for long distances, can be successfully brought into use.

The conditions which railway companies must have are:—

1. That but little room be taken up by the apparatus.
2. That the application be readily made to existing carriages at little cost.
3. That the light be better, and at less cost, taking everything into consideration, than lighting by oil.
4. That the apparatus be simple, and that each carriage be lighted independently of the others, so that they may be detached at pleasure, without putting the light out.
5. That the light last as long as the oil lamps, or say from London to York, Holyhead, Exeter, or Dover.
6. That it be as certain in its action, under all circumstances, and that defects be as readily corrected as by the present mode of lighting.

The plan adopted at the Metropolitan is not generally applicable, and only for such an exceptional line of railway as it is; for, to use gas at the mere pressure of that which is necessary for burning it, would require for the journey between London and York, half as much cubical capacity as the carriages themselves.

In order to fulfil the conditions I have named, the gas must be condensed to ten or fifteen atmospheres, and the difficulty is to reduce that pressure down to five-tenths of

an inch column of water, and to maintain it at such under all circumstances, so as to comply with the conditions I have stated, and the regulator must be entirely metallic. I am fully acquainted with all the published methods from the first introduction of gas-lighting, but not any of them comply fully with what railway companies must and will have before they generally adopt the principle of lighting railway trains with gas.

If I should succeed in accomplishing what I am trying to do, I will not fail to lay the result before the Society of Arts for discussion.

I am, &c., GEORGE BOWER.

St. Neot's, May 16, 1863.

SEWAGE OF TOWNS.

SIR,—I see that Dr. Thudichum, in his paper read before the Society last week, making allowance for daily and casual visitors, and for the rapid increase of the population of the metropolis, reckoned the human excretal matters as equal to those of about two million adult males, and takes the urine alone of these two million as worth about 10s. per head per annum. Reckoning that the supposed two million adults represent, in round numbers, three million individuals of both sexes and all ages, this brings the value of the urine per head of the actual population, according to Dr. Thudichum's data, to two-thirds of 10s., or 6s. 8d., which is exactly the value put upon the constituents of the mixed excreta (including fœces) of each individual of a mixed population, of both sexes and all ages, by Mr. Lawes and myself. Taking this valuation, from which Dr. Thudichum would obviously not widely differ, and reckoning that there are eighty tons of sewage per annum for each head of the population (some take it at more and some at less), this would give 1d. per ton for the *average* sewage of London, if valued according to the constituents of the human excretal matters it contains, taking these at the price they would command in the market if in the condition of a concentrated, dry, and portable manure, such as guano. Other matters, of course, add more or less to the value of the sewage, but their value bears but a small proportion to that of the human excretal matters.

But, in the discussion, Mr. Alderman Mechi claimed Dr. Thudichum's data as bearing out his own estimate of 16s. per head per annum, as given by him in his evidence before the Parliamentary Committee last year. This estimate, is, however, it will be observed, in point of fact, from twice to twice and a half that of either Dr. Thudichum or Mr. Lawes and myself. But Mr. Mechi went on to complain that his estimate of 16s. "was confronted by other evidence putting the value at only 2s. per head;" and as, in his recent lecture at the Farmers' Club, he complained that "Mr. Lawes puts it at 2s. per head," I suppose he again refers to the evidence of that gentleman. Now, I find by reference to the report of the Parliamentary Committee, that what Mr. Lawes said about 2s. per head was, that, in the experiments of the Royal Commission at Rugby, the result actually yielded, reckoned according to the milk obtained, was "about 2s. or 3s. per head." But when giving the value according to the constituents, he said, "The theoretical value, as far as we have got it, of each individual, is about 6s., putting that as the value of the ingredients bought as guano." Mr. Mechi must perfectly well know that it is this estimate of "about 6s." (and not the actual result of 2s. or 3s. in a particular case, when the 6s. or 7s. worth of constituents had been mixed with some 50 to 70 tons of water) that is alone fairly comparable with his own theoretical estimate of 16s. And, as the data of Dr. Thudichum, and those of Mr. Lawes and myself, given by Mr. Lawes in his paper before the Society, on March 7, 1855, are the most comprehensive brought to bear on this subject, and the estimates founded upon them are, so far as I remember, the only ones in which the questions of the sex and age of a mixed population have been duly considered in reckoning the theoretical value of the excretal matters, I am inclined to believe, and I think if Mr. Mechi carefully looks at the evidence he will agree with me in believing, that that value is much nearer 6s. 8d. than 16s. per head per annum.

But the theoretical value of the constituents contributed by the population to the sewage is one thing, and their actual value when distributed through an enormous bulk of water, as in dilute town sewage, is quite another; and Mr. Mechi has himself very recently spoken of a case (that of Croydon) in which the increased rental from the application of sewage represented only 1s. 1d. for each individual of the population, "as a very recent accessible and successful instance and evidence of the value of town sewage." In the early part of my remarks I have shown that, according to the data of Dr. Thudichum, and of Mr. Lawes and myself, the theoretical value of a ton of the *average* sewage of London is about 1d., so far as its contents in human excretal matters are concerned. Now, at Rugby, where, so far as can be judged from the evidence at present at command, the average of the total sewage does not differ very widely in composition from that of London, though as used, excluding much of the rain-fall, it is probably much stronger, the tenants who have it brought to hydrants in their fields, ready for application to either grass or arable land at pleasure, any day of the year, consider themselves very fortunate to get rid of it to others at 1d. per ton the year round. Yet it is maintained by some that farmers will be glad to pay at least 2d. per ton for sewage delivered to the boundary of their farms, with all the additional expense (by outlay of capital, or increased rental as the case may be) incident to laying down pipes over the farm, and the cost of actual distribution besides.

It certainly does seem a very great pity that any who are really anxious for the beneficial utilisation of the excretal matters of our populations, should indulge in exaggeration in their representations to the public in this matter, as nothing, surely, can tend more to postpone or prevent a satisfactory settlement of the question, than the circulation of vague and illusory statements respecting it. Indeed, so long as the value of the excretal matters of the average individual of a mixed population of both sexes and all ages is assumed to be the same as that deduced from the results of some high authority for an adult male; so long as the value of the constituents in a ton of average sewage is estimated according to the analysis of samples making no pretensions to be average samples; so long as it is maintained that the annual excretal matter of an individual of the population is equally applicable to grass land and to land under tillage, to succulent and to all other crops, and that it is to be valued by the same tariff, whether it be in the form of about half a cwt. of dry and portable powder, or distributed through from 50 to 100 tons of water, as the case may be; so long as the circumstances of a daily supply of enormously diluted sewage are spoken of as comparable with those of the liquid manure of a farm, which can be had and used in almost any state of concentration, and be applied at any time at pleasure; so long as the results obtained by irrigation in hotter and drier atmospheres are adduced as evidence of what may be expected under the influence of our own comparatively sunless summers, so long must it be concluded that it is thought not quite prudent to deal candidly with the public in this matter, and so long must this vexed question remain a source of contention, instead of what it should be, a subject treated exclusively according to the actual facts and merits of the case.

I am, &c.,
J. H. GILBERT.

Harpenden, near St. Alban's, May 20, 1863.

MEETINGS FOR THE ENSUING WEEK.

MON. ...R. Geographical, 1. Annual Meeting.
TUES. ...Royal Inst., 3. Prof. Tyndall, "On Sound."
Anthropological, 7. Prof. Busk, F.R.S., "Human Remains from Brick-earth near Chatham."

WED....Society of Arts, 8. Mr. B. H. Paul, "On Destructive Distillation, considered in reference to Modern Industrial Arts."
Royal Horticultural, 1. First Great Exhibition.
Archæological Assoc., 8½. 1. Rev. T. Owen Rocke, "On a Recent Discovery of Antiquities in Salop." 2. Mr. Powell, "On the Pedigree of Derwentwater of Castle Rigg."
THURS...Royal Inst., 3. Prof. Ansted, "On Geology."
FRI. ......Royal Inst., 8. Prof. Max Muller, "On the Vedas."
R. United Service Inst., 3. Lieut. P. H. Colomb, R.N., "Naval and Military Signals."
SAT.......Royal Inst., 3. Prof. W. Thomson, "On Electric Telegraphy."

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, May* 15*th*, 1863.]

Dated 8*th January*, 1863.

66. R. Grogan, 27, Hereford-road-north, Bayswater—New and improved propellers for vessels driven by steam or other power.

Dated 11*th February*, 1863.

369. H. Donald, Johnstone, Renfrew—Imp. in machinery for shearing, punching, and riveting metals.

Dated 18*th February*, 1863.

445. J. Platt and W. Richardson, Oldham—Imp. in machinery or apparatus for cleaning cotton from seeds.

Dated 17*th March*, 1863.

715. J. Cox, Georgie Mills, Edinburgh—Imp. in swimming baths, and in apparatus for swimming, part of which apparatus is applicable to sailing or moving vessels in a circle."

Dated 6*th April*, 1863.

871. E. T. Hughes, 123, Chancery-lane—Imp. in machinery or apparatus for manufacturing the ornamental tips of parasols, umbrellas, and similar articles. (A com.)

Dated 16*th April*, 1863.

960. A. Samuelson, 28, Cornhill—Imp. in the construction and arrangement of machinery and apparatus for the manufacture of oil.

Dated 17*th April*, 1863.

966. J. Goucher, Worksop, Nottingham—Imp. in steam boilers, and in regulating the admission of air into the furnaces of steam boilers.

Dated 20*th April*, 1863.

978. P. G. Rowell, 17, Castle-square, Brighton, and H. Holt, 14, Red Cross-street, Brighton, Sussex—A better and more economical mode of securing the bands of locomotive engine and tender springs, also a new method of applying the same.

Dated 23*rd April*, 1863.

1012. T. Richardson, Newcastle-upon-Tyne, and J. C. Stephenson, Durham—Imp. in the manufacture of sulphate of soda.

Dated 24*th April*, 1863.

1016. W. N. Wilson, 144, High Holborn, and J. G. Grey, 97, Cheapside—Imp. in machinery for sewing and stitching.

Dated 25*th April*, 1863.

1034. J. Dunbar, jun., and J. W. Woodford, 12, Sutherland-street, Walworth—Imp. in apparatus for steering and manœuvring ships and vessels.
1040. A. Legras, 64, Davies-street, Berkeley-square—Imp. in machinery or apparatus for making ices.

Dated 28*th April*, 1863.

1064. W. Clark, 53, Chancery-lane—Imp. in machinery for the manufacture of paper, and of various kinds of boards produced from fibrous substances. (A com.)
1066. J. H. Johnson, 47, Lincoln's inn-fields—Imp. in drying and cooling grain, and in the machinery or apparatus employed therein. (A com.)

Dated 29*th April*, 1863.

1082. M. Darland, Mount-street, Grosvenor-square, and E. H. Monckton, Cavendish Club, Regent-street—Imp. in apparatus for withdrawing milk from cows and other mammiferæ, and for conducting it when withdrawn to appropriate receivers. (Partly a com.)

Dated 30*th April*, 1863.

1090. E. Mitchell, Cams Alders-lodge, Fareham, Hampshire—Imp. in reaping and mowing machines.

Dated 1*st May*, 1863.

1098. W. G. Craig, Cannon-street—Imp. in feed apparatus for steam boilers. (A com.)

Dated 2*nd May*, 1863.

1100. T. L. Bissell, Charleston, North America—An improved apparatus for charging breech-loading cartridges.
1102. J. W. Gibson, 31, Lower Ormand Quay, Dublin, and W. Turner, Hammersmith Iron Works, Dublin—Imp. in springs to be used for railway buffers, draw hooks, and also for carrying springs of railway carriages and other vehicles.
1104. J. Purdey, Oxford-street Imp. in breech-loading fire-arms.
1106. J. B. Dubreuil, 108, Rue du Faubourg St. Denis, Paris—Imp. in carts, waggons, and other vehicles.

Dated 4*th May*, 1863.

1112. B. G. Sloper, Walthamstow, Essex—Imp. in apparatus for separating metals from earthy and other matters mixed with them.
1114. F. Applegate, Bradford-on-Avon, Wiltshire—Imp. in spring balances and pressure gauges.

Dated 5*th May*, 1863.

1118. E. Chesshire, Birmingham—Imp. in apparatus for intercepting the solid portions of the soil of water-closets.
1120. R. A. Brooman, 166, Fleet-street—A new fabric suitable for trimmings. (A com.)
1122. P. Bradshaw, Earls Barton Mills, Northamptonshire—Imp. in mounting or hanging mill stones for grinding grain and other substances.
1124. W. Glover, South Shields—Imp. in means or apparatus to facilitate the steering of ships and other vessels.
1126. S. B. Cochran, 48, Fleming-road, Kennington, Surrey—Imp. in sewing machines, and in apparatus connected therewith.

Dated 6*th May*, 1863.

1128. J. T. Ward, Swansea—Imp. in carriages.
1130. S. Hibbert, J. Lawton, and J. Kay, Manchester—Certain imp. in apparatus for cleansing potatoes, and in decorticating the same and other esculent roots.
1134. T. Beesley, Symond's-inn—Imp. in the construction of boxes or cases for carrying or packing bottles.
1136. C. W. Atkinson, 34, Montague-place, Russell-square—An improved steam or other motive power engine.

Dated 7*th May*, 1863.

1138. J. Park, Bury, Lancashire—Imp. in communicating motion to machinery for manufacturing paper pulp.
1140. P. Bourne, Whitehaven—Imp. in miner's lamps.
1142. A. Stanley, Walsall, Staffordshire—Certain imp. in the mode of finishing clasps and other such like metallic connectors, and which said mode of finish is also applicable to other purposes.
1144. T. Small, Bargate, Boston, Lincolnshire—Imp. in motive power machinery.

PATENTS SEALED.

[*From Gazette, May* 15*th*, 1863.]

May 15*th*.

3087. W. Dobson.
3093. J. Arbos.
3094. P. H. Klein.
3095. W. H. Burnett.
3096. E. P. Houghton.
3097. C. W. Harrison.
3098. C. Neild and J. Hopkinson.
3013. L. Lenzberg.
3105. J. Chalmers.
3108. J. Arbos.
3109. R. A. Brooman.
3116. C. Stevens.
3118. F. Fletcher.
3120. J. W. Child.
3121. F. Seiler.
3126. C. Hadfield and W. A. Attkins.
3132. T. Walker.
3138. S. Deacon and C. Deacon.
3251. R. D. Kay.
399. J. C. Jeffcott.

[*From Gazette, May* 19*th*, 1863.]

May 19*th*.

3127. J. Townsend.
3133. C. Wagner.
3137. C. A. Orth.
3139. A. Sutton.
3140. W. E. Gedge.
3141. W. E. Nethersole and C. Buckland.
3144. C. Powell.
3155. W. Tatham.
3159. A. L. Woolf.
3184. W. Clark.
3189. J. H. Johnson.
3193. W. Clark.
3207. Rev. H. Moule.
3221. P. W. Reuter.
3223. B. Oldfield.
3270. H. A. Bonneville.
3310. S. B. Whitfield.
3226. T. E. Vickers.
3383. E. Lepainteur.
3393. A. V. Newton.
24. E. Skull and E. Mealing.
253. J. Platt.
262. H. A. Bonneville.
458. N. Thompson.
517. F. A. Gatty.
521. W. Readman.
638. G. T. Bousfield.
716. W. E. Newton.
734. G. Haseltine.
770. G. Davies.
798. W. Blake.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

[*From Gazette, May* 19*th*, 1863.]

May 11*th*.

1226. W. Greeves.

May 12*th*.

1195. J. Higgins and T. S. Whitworth.
1235. J. Lees.
1382. G. Hadfield.

May 14*th*.

1193. G. H. Barth.

May 15*th*.

1225. J. D. Dunnicliff and S. Bates.
1300. G. De Laire and C. Girard.

May 16*th*.

1220. J. Cole.
1266. W. Clissold.
1270. T. Cope.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

[*From Gazette, May* 19*th*, 1863.]

May 12*th*.

1185. J. Wilkes, T. Wilkes, and G. Wilkes.
1267. W. E. Newton.

May 13*th*.

1513. A. Shanks.

May 15*th*.

1219. J. C. Pearce.

May 16*th*.

1178. G. Carter.